The Behaviour of Gases

A. Matching

Match each term in Column B with the correct description in Column A. Write the letter of the correct term in the blank provided. (1 mark each)

Column A

1. ideal gas constant (R)

2. Boyle's law

- **3.** Dalton's law of partial pressures
- 4. ideal gas law
- 5. combined gas law
- **6.** Charles's law
- 7. diffusion
- 8. partial pressure

Column B

- **a**. The volume of a fixed mass of gas is directly proportional to the Kelvin temperature if the volume is kept constant.
- b. At constant volume and temperature, the total pressure exerted by a mixture of gases is equal to the sum of the partial pressures.

c.
$$\frac{8.31L \times kPa}{K \times mol}$$

- **d.** the contribution each gas in a mixture makes to the total pressure
- **e.** A gas tends to move to an area of lower concentration until the concentration is uniform.

f.
$$\frac{P_1 \times V_1}{T_1} = \frac{P_2 \times V_2}{T_2}$$

g.
$$P \times V = n \times R \times T$$

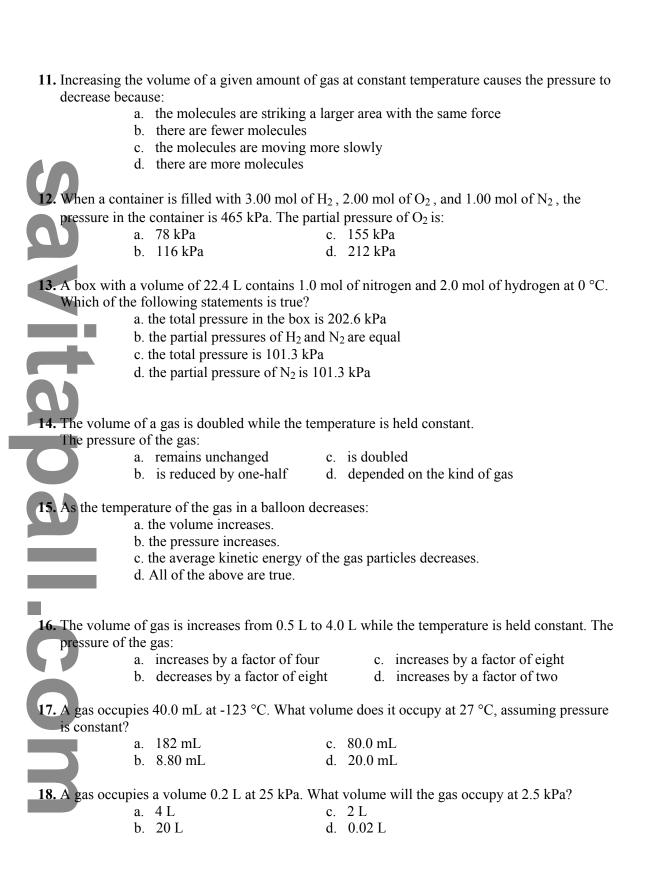
h. For a given mass of gas at constant temperature, the volume of gas varies inversely with pressure.

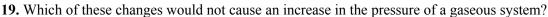
B. Multiple Choice

- **9.** As the temperature of a fixed volume of gas increases, the pressure will:
 - a. vary inversely
 - b. decrease

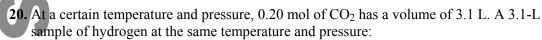
- c. remain the same
- d. increase
- 10. A breathing mixture used by deep-sea divers contains helium, oxygen, and carbon dioxide. What is the partial pressure of oxygen at 101.3 kPa total pressure if $P_{He} = 84.0$ kPa and $P_{CO2} = 0.10$ kPa?
 - a. 10.3 kPa
 - b. 17.2 kPa

- c. 34.4 kPa
- d. 185.4 kPa





- a. Another gas is added to the container.
- b. Additional amounts of the same gas are added to the container.
- c. The temperature is increased.
- d. The container is made larger.



a. has a higher density

- c. has the same mass
- b. contains the same number of molecules
- d. contains the same number of atoms
- **21.** If a balloon containing 1000 L of gas at 50 °C and 101.3 kPa rises to an altitude where the pressure is 27.5 kPa and the temperature is 10 °C, its volume there is:

a.
$$1000 L \times \frac{27.5 \, kPa}{101.3 \, kPa_1}$$

b.
$$1000L \times \frac{283 \, K}{323 \, K} \times \frac{101.3 \, kPa}{27.5 \, kPa}$$

c.
$$1000 L \times \frac{27.5 \, kPa}{101.3 \, kPa} \times \frac{323 \, K}{283 \, K}$$

d.
$$1000L \times \frac{50^{\circ}C}{10^{\circ}C} \times \frac{101.3 \, kPa}{27.5 \, kPa}$$

C. Problems

Solve the following problems in the space provided. Show your work. (3 marks each)

22. A gas has a pressure of 655 kPa at 227 °C. What will its pressure be at 27 °C, if the volume does not change?



23. A 10 g mass of krypton occupies 15.0 L at a pressure of 156 kPa. Find the volume of the krypton when the pressure is increased to 215 kPa at the same temperature.

24. A gas occupies a volume of 180 mL at 35.0 °C and 95.5 kPa. What is the volume of the gas at conditions of STP?

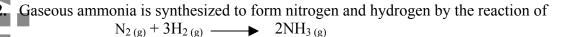
Part C: Calculation Problems

In these problems, please be certain to show the (a) original form of a formula

- (b) any formula rearrangements
- (c) any unit cancellations

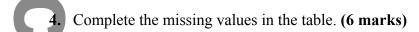
1. A sample of CO₂ gas is heated from 23.45 °C to a new temperature. The volume changed from 354 mL to 567 mL; pressure was constant during the heating process. What is the new and higher temperature which effected such volume change?

(3 marks)



Assume that you take 355 L of H₂ gas at 25 °C and 542 mm Hg and combine it with 105 L of N₂ gas measured at 20.0 °C and a pressure of 645 mm Hg. How many grams of NH₃ gas could be obtained in theory? If the ammonia gas is collected in a 125 L tank at 25 °C, what would be its pressure? (8 marks)

3. A gas at 234 mL is exposed to a temperature change of 23 to 56 °C while also experiencing a pressure change of 101.3 kPa to 129.6 kPa. What is the new gas volume? (3 marks)



Law	Equation	Constant variables	Variables that change	Derived equation
Boyle's law		n, T	<i>P, V</i>	
Charles's law	$V \propto T$		T, V	$\frac{V_1}{T_1} = \frac{V_2}{T_2}$
Avogadro's principle	$V \propto n$	<i>P, T</i>	n, V	
Combined gas law		n		$\frac{P_1 \times V_1}{T_1} = \frac{P_2 \times V_2}{T_2}$

5. Oxygen gas is generated in the lab by the thermal decomposition of potassium chlorate, KClO₃. What volume of oxygen gas (at STP) is generated from 1.00 g of potassium chlorate in the reaction. The other decomposition product is a simple slat, potassium chloride. **(6 marks)**